

420 Rec'd PCT/PTO 15 NOV 1999

Title: Inner Sole for a Shoe

~~Specification~~

*1st A1*  
*present*  
The instant invention relates to an inner sole for a shoe, which is embodied as a foot support, ~~in accordance with the preamble of claim 1, or respectively claim 4.~~

*1st A2*  
*2nd A2*  
*2nd A3*  
On the average, every fifth person in the age group between 20 and 70 years needs treatment because of diseased veins, and particularly every third person suffers from pathological vein changes which, although they do not yet need invasive treatment, nevertheless cause troubles and may need treatment in the future. In general, the cause of this often is a, genetically caused weakness of the connective tissues, which leads to a relaxation of the walls of the veins and therefore to a lack in the ability of the venous valves to close. This results in a reduction of the venous return flow from the legs into the body.

Supportive measures are known in the form of so-called pressure hose, but preventive measures are unknown, in particular in connection with people who, because of their occupation, perform predominantly sitting or standing tasks. In these cases it is suggested to move the legs as much as possible in order to increase the venous return flow from the legs back into the body by promoting the so-called foot and calf muscle pump. This is aided to a great extent by walking barefoot, however, the shoes which are customary these days have a rather disadvantageous effect.

Walking shoes are known, wherein resilient layers in the form of supports are used in the heel area. But these known resilient layers are merely intended to compensate the specific overloads occurring during walking, or at least to assist in partially preventing them (DE 39 02 872 A1).

In connection with an orthopedic inner sole for shoes known from ~~DE 87 00 681 U1, the pillow like~~ <sup>*Garman Patent, cushioned*</sup> layers are also embodied as an arched padding, which protrudes upward above the covering layer of the soles, and is provided in one piece with a large surface for support and pressure distribution in defined areas of the foot. An inner sole for a shoe is moreover known from ~~DE 35 08 582 C2~~ <sup>*Garman Patent*</sup>, which has a resilient padding in the area of the reflex zones of the foot. This padding has a symmetrically or asymmetrically concavely arched, or respectively bulged shape, and is essentially circular <sup>*when viewed*</sup> ~~in a view~~ from above, and is therefore used for stimulating the nerves in these reflex zones. The reflex zones in the feet have an exclusive effect on the nervous system which, inter alia, affects the arterial blood supply of defined organs. No remedy for the problems of venous outflow of blood mentioned at the outset, in particular in the area of the lower leg, can be achieved by this.

*shorten* It is therefore <sup>*on*</sup> the object of the present invention to ~~create~~ <sup>*Provide*</sup> an inner sole for a shoe of the type mentioned at the outset, which makes possible a considerable improvement of the venous return flow through the legs into the body, starting at the foot, by means of synergistic support of the muscle contraction in the course of the movement of the foot and ankle joints.

*shorten* To attain this object, the ~~characteristics recited in claim 1, or respectively in claim 4,~~ are provided in connection with an inner sole for a shoe of the type mentioned.

Suitable support areas, which positively affect a contraction of the musculature of the foot, result from the steps in accordance with the invention, wherein the ~~pillow like~~ <sup>*present*</sup> ~~cushioned~~ layers are not raised separately, but are placed in a plateau-like manner into defined areas of the foot and are divided into fields which are separated from each other. These discrete support points are arranged in such a way that the muscle

contraction is prompted, or respectively stimulated and therefore improved during the normal movement of the foot, but also considerably while standing. This results in a synergistic support during the movement sequence of the individual joints which, as a continuous homogeneous movement wave, has a positive effect on the venous and lymphatic vessel system. In other words, a homogeneous mechanical squeezing of the venous and lymphatic vessel system takes place, which leads to an increase in the venous return flow from the legs in the direction toward the body. This characteristic support movement promotes the action of the so-called foot and calf muscle pump, in particular since the division of the ~~pillow-like~~ <sup>cushioned</sup> layers into individual areas is similar to the arrangement of the muscles in the foot.

*present invention*

With further embodiments in accordance with the ~~characteristics of claim 2 and/or 3 and/or 5 and/or 6, pillow-like~~ <sup>cushioned</sup> layers are provided in further important areas of the muscle arrangement.

~~Alternative embodiments are the result of the characteristics of claim 7, or respectively claim 8. It is practical here to provide the characteristics in accordance with claim 9 or 10.~~

~~Further advantageous embodiments result from the characteristics of one or several of claims 11 to 15.~~

*one embodiment*

In accordance with ~~the characteristics of claims 16 or 17~~, the inner sole for a shoe can either be individually employed as an insole, or it is provided as a sole which is directly integrated into a shoe.

*present*

Further details of the ~~invention~~ can be taken from the following description, in which the exemplary embodiments represented in the drawings are described in detail and explained. ~~Shown are in.~~

*Ansatz*  
A Fig. 1, *is* a view from above on an inner sole of a shoe in accordance with a first exemplary embodiment of the present invention, *X*

A Fig. 2, *is* a section along the line II - II in Fig. 2 in an enlarged view,

A Fig. 3, *is* a section along the line III - III in Fig. 1 in an enlarged view, and

A Figs. *are* 4 and 5, *is* respectively a section similar to the one in Fig. 3, but in accordance with two variants of the first exemplary embodiment,

A Fig. 6, *is* a view from above on an inner sole of a shoe in accordance with a second exemplary embodiment of the present invention,

A Fig. 7, *is* a longitudinal section similar to the one in Fig. 3, but through the second exemplary embodiment,

A Fig. 8, *is* an interior view in the longitudinal direction of the second exemplary embodiment,

A Fig. 9, *is* a view from above on the pre-processing stage of the inner sole of the shoe in accordance with the second exemplary embodiment of the present invention,

A Fig. 10, *is* a longitudinal sectional view similar to the one in Fig. 7, but in the longitudinal direction of Fig. 9,

A Fig. 11, *is* a view from above on an inner sole of a shoe in accordance with a variant of the second exemplary embodiment of the *present* invention, and

A Fig. 12, *is* a longitudinal section similar to the one in Fig. 7,

but through the variation of the second exemplary embodiment.

The inner sole 11, or respectively 111, or respectively 111' represented in the drawings and embodied as a foot support, for example, in accordance with two exemplary embodiments and a variant of the second exemplary embodiment of the present invention, is used for the synergistic support of the musculature in the course of the movement of the foot and ankle joints for improving the conveyance of fluids in the venous and lymphatic vessel system through the legs, and it can be embodied as an insole or as a sole integrated into a shoe.

As can be seen from Figs. 1 and 6, the inner sole 11, or respectively 111 has several ~~pillow-like~~ *cushioned* layers 12 to 16, or respectively 112 to 116 provided over the sole surface 17, or respectively 117, of which the ~~pillow-like~~ *cushioned* layers 12, 112, 13, 113 and 14, 114 are divided into separate, plateau-like fields 18 to 22, 118 to 122, or respectively 23 to 25, or respectively 123 to 125, or respectively 26, 27, 126, 127, which are separated from each other.

The first ~~pillow-like~~ *cushioned* layer 12, 112 is provided in the forefoot joint area, i.e. in the area of the toes. This first ~~pillow-like~~ *cushioned* layer 12, 112 is divided into five fields 18 to 22, 118 to 122, which are separated from each other and arranged next to each other in the transverse direction of the inner sole 11, 111. The individual fields 18 to 22, 118 to 122 are of different width and length, approximately corresponding to the base area of the partial areas of the respective individual toes. This is correspondingly true for the shape of the front and rear borderline 28, 128, or respectively 29, 129, of this first ~~pillow-like~~ *cushioned* layer 12, 112. The second ~~pillow-like~~ *cushioned* layer 13, 113 is provided in the transition area between the metatarsus and the tarsus and in an area facing away from the plantar arch. This second ~~pillow-like~~ *cushioned* layer 13,

113 is divided into three fields 23 to 25, 123 to 125, which are shaped to correspond to this partial area of the metatarsus/tarsus and are arranged divided and lying next to each other in the transverse direction of the inner sole 11, 111. This is correspondingly true for the circumferential borderline 31, 131 of this second ~~pillow like~~ <sup>cushioned</sup> layer 13, 113. The third ~~pillow like~~ <sup>cushioned</sup> layer 14, 114 is provided in a transition area between the metatarsus and the heel and divided into the two fields 26, 126 and 27, 127 which, viewed in the transverse direction of the inner sole 11, 111, lie next to each other and are provided laterally on the outside. Here, too, the circumferential borderline 32, 132 approximately corresponds to the transition area between the metatarsus and the heel.

The fourth ~~pillow like~~ <sup>cushioned</sup> layer 15, or respectively 115, is arranged in the area of the heel and is designed in a plateau-like manner as a uniform, non-divided layer, which is approximately oval in the transverse, or respectively longitudinal direction of the inner sole 11, 111. The fifth ~~pillow like~~ <sup>cushioned</sup> layer 16, 116 is also embodied as a uniform, non-divided layer, but is provided in the approximately shape of a sickle in the area of the plantar arch.

The ~~pillow like~~ <sup>cushioned</sup> layers 12 to 16, 112 to 116 are made of a resilient (foam) material, for example silicon. They have a flat upper surface and are embodied to be approximately rectangular, advantageously slightly trapezoidal, in cross section.

In the first exemplary embodiment in accordance with Figs. 1 to 3, the inner sole 11 has a sole base body 36, which here is triple-layered, <sup>and</sup> constitutes the basic shape of the inner sole 11 and in accordance with Fig. 1 is designed to correspond to a foot, here the right foot. It is understood that the corresponding other, i.e. left inner sole 11, is designed to be mirror-symmetrical. The sole base body 36 consists, for

example, of three cork layers 33, 34, 35. A sole cover layer 37 which, for example is made of leather, is provided on the sole base body 36. The ~~cushioned~~ ~~pillow-like~~ layers 12 to 16 are arranged in the sole base body 36 in a recessed manner between the sole base body 36 and the sole cover layer 37. The upper and center layers 33, 34 of the sole base body 36 are provided with corresponding depressions 38 for this purpose which, corresponding to the fields 18 to 27 of the ~~pillow-like~~ layers 12 to 14 and corresponding to the ~~pillow-like~~ layers 15, 16, have different base surfaces. The depressions 38 have been worked into the sole base body 36 to such a depth that the respective flat top of the plateau-like, ~~pillow-like~~ layers 12 to 15 lies approximately in a plane, i.e. co-planar with the surface of the sole base body 36. The ~~cushioned~~ ~~pillow-like~~ layer 16 constitutes an exception. With this exemplary embodiment the depressions 38 extend as far as the top of the lower layer 35. Among themselves, the ~~cushioned~~ ~~pillow-like~~ layers 12 to 15 are of approximately the same height and are in a range between 2 to 5 mm, preferably in a range at 3 mm. The material of the top, or respectively the sole cover layer 37, covers the ~~pillow-like~~ layers 12 to 16 in such a way, that they, or respectively their fields 18 to 27, are enclosed by a depression along the edge and are fixedly connected with, preferably glued to, the central layer 34 of the sole base body 36, so that, besides the borderlines 28, 29 and 31, 32, intermediate borderlines 41 to 47 result, which extend approximately vertically ~~in~~ <sup>with</sup> respect to the transverse direction of the inner sole 11. In other words, the depressions 38 are designed to correspond to the total base surface of the ~~cushioned~~ ~~pillow-like~~ layers 12 to 15.

With the two variants ~~of this~~ in accordance with Figs. 4 and 5, the surface arrangement of the ~~cushioned~~ ~~pillow-like~~ layers 12 to 15 of the inner sole 11 of the shoe, including the arrangement of the fields 18 to 27, is exactly the same as shown in Fig. 1 <sup>with</sup> ~~in~~. The essential difference of the variants in Figs. 4 and 5 <sup>in</sup> respect to the exemplary embodiment of Figs. 2 and 3 rests in that a ~~cushioned~~ ~~pillow-like~~ resilient intermediate layer 51', or

respectively 51'' is provided over the entire surface of the sole base body 36' between the sole base body 36', or respectively 36'', and the sole cover layer 37', or respectively 37''. Here, the intermediate layer 51 is made of the same resilient material as the ~~pillow-like~~ layers 12 to 16 and is fixedly connected with, preferably glued to, the entire surface of one of the layers 34' (Fig. 4), or respectively 35'' (Fig. 5), which have no depressions, of the sole base body 36'.

In accordance with Fig. 5, the ~~pillow-like~~ intermediate layer 51'' is of a thickness in the range between 2 to 3 mm, which is approximately uniform over the entire base surface, so that a continuous flat ~~pillow~~ <sup>cushion</sup> results, which is considerably more resilient than the layers of the sole base body 36'. Compared with Fig. 3, in this variant of the intermediate layer 51'' has been placed over the entire surface between the lower layer 35' and the center layer 34''.

In accordance with Fig. 4, the intermediate layer 51' lies between the center layer 34' and the upper layer 33' and has a different thickness. Accordingly, here the upper layer 33' is provided with depressions 38', and the ~~pillow-like~~ intermediate layer 51' with depressions 52 corresponding to the depressions 38' for receiving the ~~pillow-like~~ <sup>cushioned</sup> layers 12 to 16, over which the upper material, or respectively the sole cover layer 37' again extends in the same way as the sole cover layer 37 in accordance with Figs. 2 and 3.

With the second exemplary embodiment in accordance with Figs. 6 to 10, the inner sole 111 has a dual-layer sole base body 136, which constitutes the basic shape of the inner sole 111 and which in accordance with Fig. 6, or respectively 9, is designed to correspond to a foot, here the left foot. It is also understood here that the corresponding other, i.e. the right inner sole, is designed to be mirror-symmetrical. The sole base body 136 is constructed from two cork layers, for

example. A sole cover layer 137 is provided on the sole base body, which is made of leather, for example.

*cushioned*  
The ~~pillow-like~~ layers 112 to 115 are arranged between the sole base body 136 and the sole cover layer 137 in a recessed manner. The sole base body 136 is provided with corresponding depressions 138 for this purpose which, corresponding to the fields 118 to 127 of the ~~pillow-like~~ layers 112 to 114 and corresponding to the ~~pillow-like~~ layer 115, have a different base surface. Figs. 9 and 10 show the corresponding depressions 138 in a view from above, or respectively in section. Thus, the sole base body 136 has a maximum thickness in the range between 3.5 to 4 mm, preferably 3.7 mm, and a minimum thickness in the area of its depressions 138 between approximately 1 mm and 1.5 mm, preferably 1.3 mm. It is furthermore indicated in Fig. 9 that the entire surface 136 of the sole base body 136, which for example is multi-layered, is covered with a thin textile cover 139. It is possible in a manner not shown that, instead of or in addition to this, the underside 154 of the sole base body 136 can be covered over its entire length with such a thin textile cover. The sole base body 136, or respectively its layers, are made of cork scrap compacted by means of a binder.

*152*  
In accordance with Fig. 7, the entire surface 153 of the sole base body 136 is moreover covered with a resilient, or respectively ~~pillow-like~~ intermediate layer 151. The intermediate layer 151 thus covers the entire surface, including the depressions 138 of the sole base body 136, so that depressions 152 corresponding to the depressions 138 remain in the intermediate layer 151. The intermediate layer 151 has a continuous thickness of, for example, approximately 3 mm. The same as the ~~pillow-like~~ layers 112 to 116, the intermediate layer 151 is preferably made of a foamed material, for example foamed natural latex.

*cushioned*  
The ~~pillow-like~~ layers 112 to 115 have been placed into the

depressions 152 of the intermediate layer 151 and consist, for example, of the ~~said~~ foamed natural latex and have a thickness in the range between 4 and 5 mm, preferably of 4.5 mm, for example. In contrast thereto, the ~~pillow-like~~ <sup>cushioned</sup> layer 116 for the plantar arch of the foot is not arranged in a depression, but directly on the intermediate layer 151, which in this area is flat, i.e. not provided with depressions. On its thickest part, this ~~pillow-like~~ <sup>cushioned</sup> layer 116 also has a thickness of approximately 4 to 5 mm, preferably 4.5 mm, wherein its thickness continuously decreases toward the inside of the sole 111. Thus, the flat surfaces 156 of the plateau-like, ~~pillow-like~~ <sup>cushioned</sup> layers 112 to 115 are raised by 1.5 to 2.5 mm, preferably approximately 2 mm, above the surface 157 of the intermediate layer 151. The material on the top, or respectively the sole cover layer 137, covers the ~~pillow-like~~ <sup>cushioned</sup> layer 116 and furthermore the ~~pillow-like~~ <sup>cushioned</sup> layers 112 to 115 in such a way that the latter, or respectively their fields 118 to 127, are enclosed by a depression along the edge and are fixedly connected with, preferably glued to, the intermediate layer 151 so that, besides the borderlines 128, 129 and 131, 132, intermediate borderlines, or respectively areas 141 to 147, result, which extend approximately vertically <sup>with</sup> respect to the transverse direction of the inner sole 111.

The variant represented in Figs. 11 and 12 differs from the second exemplary embodiment only in the design of the second ~~pillow-like~~ <sup>cushioned</sup> layer 113'. Figs. 11 and 12 for this variant have the same reference numerals as those in Figs. 6 to 10, only a prime has been added.

In accordance with Figs. 11 and 12, the second ~~pillow-like~~ <sup>cushioned</sup> layer 113' is provided with the outer field 125', the center field 124' and the inner field 123', wherein the two former are designed in accordance with the representations in Figs. 6 and 7. In comparison with the field 123 in Fig. 6, the inner field 123' of the second ~~pillow-like~~ <sup>cushioned</sup> layer 113' has been pulled forward in a bow shape toward the first ~~pillow-like~~ <sup>cushioned</sup> field 113.

layer 112'. This bow-shaped extended area 123' lengthens and widens the front surface of the field 123'. As can be seen in Fig. 12, this bow-shaped extended area 123' is not level like the remaining surface areas of the ~~pillow-like~~ <sup>cushioned</sup> layer 113', but is arched upward, i.e. again raised in relation to the raised surface of the sole cover layer 137'. This arching raises the level of the bow-shaped extended area 123' in relation to the remaining area of the field 123' and the fields 124' and 125' by approximately 2 mm.